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# THE EFFECTIVENESS OF FORMULATING A STORY REPRESENTATION AMONG CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER AND COMPARISON CHILDREN

Benjamin D. Freer  
*University of Kentucky*

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## ABSTRACT OF THESIS

### THE EFFECTIVENESS OF FORMULATING A STORY REPRESENTATION AMONG CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER AND COMPARISON CHILDREN

Children with ADHD perform more poorly in school than comparison children. Although many factors may play a role in this academic deficit, story comprehension deficits have been identified that reveal difficulties with higher cognitive processes. This study investigated how effectively children with ADHD formulate story representations when given little or no story structure. The production of goal-based stories was the major focus. Children with ADHD and comparison children created a story when no story structure was provided (free story) and when some story structure was provided (4-picture story). The stories were measured for coherence, use of goal-attempt-outcome (GAO) sequences and goal-based story grammar categories. Children with ADHD had difficulty structuring a story and utilizing a goal plan in both story tasks. The provision of story structure reduced some group differences. These results supplement evidence of problems among children with ADHD in using goal plans to formulate story representations.

KEYWORDS: Storytelling, Attention Deficit Hyperactivity Disorder, Child Development, Story Comprehension, Academic Achievement

Benjamin D. Freer

3/21/2008

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COMPARISON CHILDREN

By  
Benjamin D. Freer

Elizabeth P. Lorch, Ph. D

Co-Director of Thesis

Richard Milich, Ph. D

Co-Director of Thesis

David Berry, Ph. D

Director of Graduate Studies

3/21/2008

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Benjamin D. Freer

The Graduate School

University of Kentucky

2008

THE EFFECTIVENESS OF FORMULATING A STORY REPRESENTATION AMONG  
CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER AND COMPARISON CHILDREN

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Thesis

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A thesis submitted in partial fulfillment of the  
requirements for the degree of Master of Science in the  
College of Arts and Science  
at the University of Kentucky

By

Benjamin D. Freer

Lexington, KY

Co-Directors: Dr. Elizabeth P. Lorch, Professor of Psychology  
and Dr. Richard Milich, Professor of Psychology

Lexington, KY

2008

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## **Chapter One**

### **Introduction**

This study investigated how effectively children with ADHD formulate story representations when given little or no story structure. Children with ADHD perform more poorly in school than comparison children (O'Neill & Douglas, 1991). Although many factors may play a role in this academic deficit, story comprehension deficits have been identified that reveal difficulties with higher cognitive processes. These story comprehension and representation deficits include problems in the use of causal structure to guide story recall, in the construction of coherent stories, and in the maintenance of goal structure while narrating stories. Prior research in this area has focused on the identification of group difference in story comprehension when providing a relatively large amount of story structure and story information to the children via cued and free recall of stories and on-line narration (Lorch, Berthiaume, Milich, & van den Broek, 2007). The present study filled a gap in the research by determining the qualitative and quantitative differences between children with ADHD and comparison children in the production of a coherent goal-based story representation when the children are given few or no story cues and the children must utilize their own knowledge of story structure.

ADHD is a pervasive developmental disorder that affects between 5% and 10% of children in school and is characterized by inattentive and hyperactive/impulsive symptoms. These symptoms relate to behaviors that negatively affect school performance, such as being off task, completing less school work than other students, leaving their seats during class, and engaging in disruptive behaviors like inappropriately calling out. These common inappropriate behaviors are associated with a myriad of impairments including lack of academic success (Henker & Whalen, 1989) and poor

social relations with peers and adults (Landau & Milich, 1988). The inappropriate behaviors also predict an increased risk of long-term adverse outcomes such as psychiatric disorders and substance abuse (Barkley, 2006).

One of the most significant areas of impairment among children with ADHD is in academic functioning. Children with ADHD perform more poorly than comparison children on nearly every academic measure. These children perform more poorly on standardized achievement tests and earn lower grades than other students. Also, children with ADHD are more likely to be held back, fail subjects, and drop out of school. These academic difficulties in childhood lead to problems in adulthood such as lower occupational status than expected and increased frequency of occupation changes (Barkley, Fischer, Smallish, & Fletcher, 2006).

There have been many studies relating academic difficulties with attentional problems experienced by children with ADHD based on the completion of less work due to off-task behavior (Lorch, Berthiaume, Milich, & van den Broek, 2007). However, only a few studies have examined academic problems with higher order cognitive processes that are necessary for story comprehension and representation. Story comprehension requires the ability to allocate attention to plot-relevant information, monitor comprehension, use the story to retrieve significant story events, and create story representations that reflect causal connections among events (Nezworski, Stein, & Trabasso, 1982; Trabasso, Secco, & van den Broek, 1984; van den Broek, Lorch, & Thurlow, 1996). In addition, story comprehension requires the ability to understand character goals, story themes, and plans (Schank & Abelson, 1977). Story comprehension may have implications for early academic success, so story comprehension research represents an important area of investigation among children with ADHD.

Several theoretical models of story comprehension have been proposed. Two theoretical models that explain the process by which details are organized to create an understandable story are most relevant to this study. The first, the Story Grammar Model, asserts that some aspects of a story are remembered better than others due to their function within the story (Mandler & Johnson, 1977; Stein & Glenn, 1979). In this model, the story begins with setting information, followed by an initiating event that creates an overall goal plan for the main character. Following the establishment of the goal plan, there are attempts by the main character to achieve the goal, which leads to an overall story outcome (Mandler & Johnson, 1977). The Story Grammar Model gives special emphasis to goal-attempt-outcome (GAO) sequences within stories. These GAO sequences generally are the most important idea units in a story and are expected to be remembered better than other aspects of a story (Goldman & Varnhagen, 1986; Mandler & Johnson, 1977; Nezworski, Stein, & Trabasso, 1982; van den Broek, 1989).

The second theoretical model, the Causal Network Model, expands the Story Grammar Model by adding the idea that the story events are related through a network of causal connections (Trabasso & van den Broek, 1985; Trabasso, van den Broek, & Suh, 1989; van den Broek, 1990). An important measure derived from this network representation is the number of causal connections an event has to other events in the story. The greater the number of causal connections one event has to other events within a story, the better the recall of that event (Trabasso & Sperry, 1985; Trabasso & van den Broek, 1989). From this perspective, goals are important because they are connected to many antecedents and consequences throughout the story.

The Story Grammar Model and Causal Network Model create the foundation for story research. A number of approaches to studying story comprehension and story

representation of children with ADHD have been utilized. Initial studies of differences in story comprehension between children with ADHD and comparison children inferred comprehension from children's ability to remember events, actions, and outcomes of a story. Research directed at these issues utilized cued and free recall of stories. Because the present study examines story representation when little or no story structure is provided, this prior research will be reviewed in the order of the most story structure provided in the task to the least.

Cued recall requires the child to listen to a story and then answer directed questions assessing memory for specific events or connections among events. In several studies of cued recall of televised stories, no significant group differences were found between children with ADHD and comparison children in recall of factual information, regardless of the child's degree of visual attention. Children with ADHD performed as well as comparison children when no distracters were present on questions testing causal relations (Landau, Lorch, & Milich, 1992; Lorch et al., 2000, Study 1); however, when distracters were present, children with ADHD performed more poorly on questions testing causal relations due to reduced visual attention to the television (Lorch et al., 2000, Study 2; Lorch, Eastham et al., 2004). These findings indicate children with ADHD have a deficit in recall of causal relations when attention is distracted, but do not have a generalized deficit in story comprehension. Lorch, Eastham et al. (2004) present evidence that a deficit in maintaining cognitive engagement with televised stories when distracters are present may be responsible for poorer recall of causal information among children with ADHD.

Free recall requires the child to listen to a story and then retell the story from memory. The free recall task eliminates the direct questions inherent in the cued recall

task that may provide additional story information and structure for a child's answer. The free recall task creates a situation in which the child must use the understanding of what components of the story are most important in order to retrieve and organize story information. Although early studies (Tannock, Purvis, & Schachar, 1993; Purvis & Tannock, 1997) failed to find diagnostic group differences in the degree to which thematic importance influenced story recall, several recent studies have converged on a different pattern of results. Although children with ADHD did show some sensitivity to the thematic importance of story events, the number of causal connections or degree of thematic importance had less impact on the recall of children with ADHD than that of comparison children, both for televised stories (Flake, Lorch, & Milich, 2007; Lorch, Sanchez et al., 1999) and for auditory presented folktales (Lorch, Diener et al., 1999; Lorch, O'Neil et al., 2004). In addition, Flake et al. (2007) found the free recall of children with ADHD was less coherent than that of comparison children, but only when toys were present during the viewing.

Research using cued and free recall tasks indicates difficulties recalling important and causally connected events among children with ADHD. However, the ongoing processes of how a child tells a story must be examined to gain a better understanding of the story representation abilities of children with ADHD. Past research has utilized a wordless picture book to provide a guiding framework while telling the story because one picture is always available to the child. The on-line narration task limits the memory demands common with cued and free story recall tasks while maintaining the importance of story details and events within a story structure by requiring the child to narrate a story using a wordless picture book. In order to produce a story the child must understand the necessity of a goal-plan that leads to the completion of an overall goal (Trabasso, Stein,



Rodking, Munger, & Baughn, 1992). In addition, the importance of causal connections must be recognized to understand that each event occurs in a serial manner and must be connected to other events across time.

At this time there have been three studies utilizing the on-line narration task to test story comprehension of children with ADHD. The first study focused on the elements of stories, such as the number of idea units, causal connections, and number of errors in children 6-10 years old (Milch-Reich, Campbell, Pelham, Connelly, and Geva, 1999). Children with ADHD and comparison children encoded the same number of concrete concepts; however, children with ADHD generated fewer causal connections. This demonstrated a difficulty creating links between story events and suggests a deficit in integrating incoming story information based on causal links. However, the stories used in this study included only seven pictures that contained no hierarchical goal structure, and the information from the stories were coded based only on idea units, errors, and causal connections. Based on the Story Grammar Model and Causal Network Model, to understand stories a child must recognize the importance of goals, outcomes, and story structure, which were not present in the story used in the Milch-Reich et al. study.

Renz et al. (2003) used a longer story with a hierarchical goal structure to investigate on-line narrations of 9-11 year-old children with ADHD and comparison children. The story used, *Frog, Where are you?* (Mayer, 1969) contained 24 pictures. This story has been used in numerous studies to investigate developmental differences in story comprehension and representation (Trabasso & Nickels, 1992; Trabasso & Rodkin, 1994). The story contains an initiating event (the boy loses his frog), followed by several unsuccessful attempts to find the frog (the boy looks for the frog in several locations), and finally culminates in the main character attaining the overall goal (the boy finds his

frog and takes it home). The narrations produced by the children with ADHD and comparison children were coded for errors and according to story grammar categories, such as the setting, goal, and outcome (Renz, et al., 2003).

Renz et al. (2003) found that children with ADHD included the completion of the overall goal significantly less often than comparison children. This finding suggests that children with ADHD have a greater difficulty maintaining a goal plan throughout a story narration. Children with ADHD also included fewer linked attempts to achieve the goal and made more repetition and ambiguous reference errors than comparison children, which suggests difficulty using a goal plan to guide story narration. However, both groups produced a similar number of total idea units, setting statements, unlinked attempts, and event statements in their narrations. In a similar study (Flory et al., 2006) using children 7-9 years of age, children with ADHD were less likely to include the initiating event, completion of the overall goal, and goal-attempt-outcome (GAO) sequences than comparison children. Children with ADHD also made significantly more repetition, within clause (unclear or ambiguous language), and whole clause errors (stating an event that did not occur or stating the events out of order) than comparison children (Flory et al., 2006). These differences between the two groups suggest children with ADHD may have a deficit representing goal-based story structure but not with overall story production.

The on-line narration task requires the child to create a story representation; however, the child is given information to structure a story through the use of the picture book. Would children with ADHD and comparison children differ in their story representations if provided little or no information to structure a story? One study has investigated the differences between children with ADHD and comparison children based

on verbal productivity (number of words produced during the story telling) when the child is given little or no story structure. Deficits in verbal production were found in two situations, when the child told a story based on no story cues and when the child told a story based on four pictures (Zentall, 1988). This suggests children with ADHD may have general production deficits in story representation due to difficulties with organization and planning that are required to maintain story structure. However, this study focused on verbal production, which does not allow evaluation of the way children with ADHD coherently structure stories.

### ***The Present Study***

The present study built on previous findings (Zentall, 1988; Renz et al., 2003; Flory et al., 2006; Stein & Albro, 1997) by examining the ability of children with ADHD to create story representations based on their own knowledge of stories when given little or no story structure. Children were selected from two age ranges (5.5-8.4 years and 8.5-11.4 years) to allow examination of potential differential patterns of development by diagnosis and age. The children told two stories: one story with no cues for the story and one with four pictures to cue the story (Zentall, 1988).

Four questions guided this investigation. First, do children with ADHD and comparison children differ in the coherence of the story representation produced? Flake et al. (2007) found children with ADHD produced less coherent stories on a free recall task, although this occurred only when distracters were present. In the present study children created a story representation with little or no story structure as opposed to the large amount of story structure provided in a free recall task. If children with ADHD create less coherent story representations, then this may indicate they are not correctly planning a story, accurately utilizing their memory of the story plan, or understanding the

important elements of a story. Past research suggests children with ADHD will produce less coherent stories than comparison children.

Second, do children with ADHD and comparison children differ in the production of goal-based stories? Flory et al. (2006) found children with ADHD produced fewer goal-attempt-outcome (GAO) sequences than comparison children in an online narration task. The production of a goal-based story was measured to determine if the child included at least one GAO sequence (a valid story) and to determine the number of GAO sequences the child included in the created story (story complexity). The narratives were coded for the inclusion of an initiating event, attempt, and outcome (GAO sequence). A goal-based narrative contains an overall integrated goal-attempt-outcome (GAO) sequence and often contains more than one GAO sequence if the goal is not immediately resolved (Stein, 1988). GAO sequences are vital to story representations because they represent the importance of goal structure and lead to better organized and more coherent stories. The presence of GAO sequences within a narrative creates greater causal relation between events (Stein & Glenn, 1979; Johnson & Mandler, 1980; Stein & Trabasso, 1982). In addition, a positive correlation has been found between GAO sequences and the complexity of a narrative (Stein & Albro, 1997). Based on past research, children with ADHD are expected to produce fewer valid stories and stories that are less complex than comparison children.

Third, do children with ADHD show deficits in producing goal-based events? Although earlier studies have demonstrated comparison children's superior ability to utilize a provided story structure (Renz et al., 2003; Flory et al., 2006), the present study will determine whether this superiority persists when the children are given little or no story structure to guide the narrative. Due to the difficulties that children with ADHD

experience with the essential aspects of a goal-plan (Lorch et al., 1999, 2; Renz et al., 2003; Flory et al., 2006; Flake et al., 2007), the narratives were measured for the inclusion of the important goal-based story grammar categories; initiating events (sets up the overall goal), attempts (actions directed toward resolution of the story goal), and outcomes (overall resolution of initiating event). Past research suggests children with ADHD will less frequently include initiating events, attempts, and outcomes than comparison children.

Finally, are there any developmental differences in any of the measures for children with ADHD and comparison children? I expect that for both diagnostic groups, older children will create stories that have better story coherence, higher frequency of meeting the criterion of a valid story, more complex stories, and all goal-based measures in the older age group. Also, of greater interest, if a developmental difference exists, there may be different quantitative or qualitative patterns of stories produced based on an interaction between age and diagnosis. For example, it is possible that as children with ADHD age they become more similar to comparison children in the quantitative and qualitative measures.

## **Chapter Two**

### **Method**

#### ***Participants***

This study was part of a larger longitudinal study examining story comprehension and representation among children with ADHD. For this study, the sample included 155 children. The children were divided into groups based on age (younger=5.5 to 8.4 years old and older=8.5 to 11.4 years old during the present study) and diagnosis (ADHD and comparison children). These groups included 24 younger children with ADHD, 57 younger comparison children, 25 older children with ADHD, and 49 older comparison children.

The present study included two story tell tasks, the free story and 4-picture story tell, which will be described. Some children were excluded from analysis in the study for several reasons. On the free story tell, 25 children were excluded from the analysis. Of these excluded children, 21 children refused to create a story (10 younger comparison children, 4 younger children with ADHD, 4 older comparison children, and 3 older children with ADHD), 1 child created a story that was an outlier based on story length (1 older child with ADHD told a story 43 standard deviations above the mean), 2 children created stories they stated to have heard before (1 younger comparison child and 1 older child with ADHD), and 1 child was accidentally prompted by a research assistant (1 younger comparison child). Thus, 130 children created a free story. The children that created a free story included 20 younger children with ADHD, 45 younger comparison children, 20 older children with ADHD, and 45 older comparison children. There was no diagnostic or age group difference in the children excluded from the analyses.

On the 4-picture story tell, 6 children were excluded from the analysis. Of these excluded children, 4 children refused to create a story (1 younger comparison child, 1 younger child with ADHD, 1 older comparison child, and 1 older child with ADHD) and 2 children created stories that were outliers based on story length (2 older children with ADHD told stories 7 standard deviations above the mean). Thus, 149 children created a 4-picture story. The children that created a 4-picture story included 23 younger children with ADHD, 56 younger comparison children, 22 older children with ADHD, and 48 older comparison children. There was no diagnostic or age group difference in the children excluded from the analyses.

This study was conducted 18-21 months after initial intake. Children with ADHD were referred from a university psychiatric clinic. The clinic diagnoses were made independently of the research study and created a pool of potential participants. Children with attentional problems only were not included due to increasing evidence of differences between the predominately inattentive and combined groups that indicate the inattentive group may be a distinct disorder (Milich, Balentine, & Lynam, 2001). Children were excluded if they were taking psychiatric medications that could not be withheld on the days of the study, such as antidepressants.

To confirm the child's diagnosis of ADHD, a semi-structured interview was conducted with a parent, usually the mother, by an advanced graduate student trained in the interview procedure. The interview was conducted the first day of the study and consisted of items corresponding to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) (1994) ADHD diagnostic criteria. In the interview, parents were asked whether their child exhibited any of the ADHD symptoms and to give an example of symptomatic behaviors. Parents were also asked whether they believed

their child's behaviors were age-appropriate and if they impaired school or social performance. Any child who did not meet the DSM-IV (1994) ADHD diagnostic criteria (i.e., 6 or more age-inappropriate, impairing symptoms of impulsivity/hyperactivity and/or 6 or more impairing symptoms of inattention) was excluded from participation in the study.

Comparison children were recruited through advertisements in several newspapers and flyers distributed throughout the community. Interested parents were initially screened over the phone about their child's history of behavior, learning, or attention problems. An interview was conducted during the first day of the study to verify the children did not meet three or more criteria for ADHD or oppositional defiant disorder (ODD). Children that met three or more criteria for ADHD or ODD were excluded from further participation.

On the days of testing parents of children with ADHD were asked to withhold psychiatric medications. Parents were contacted the day before testing to remind them of this and upon arrival for testing were asked whether the child was medication-free. If the child had taken medicine the day of the testing they were asked to reschedule their session for a later date.

Parental consent for the study was obtained prior to each child's participation. Children completed the testing session for this study in one day that lasted approximately one and a half hours. The children were offered frequent breaks, tasks were interspersed to divide similar tasks, and children were allowed to choose a small toy at the beginning and end of the testing session to maintain participants' interest and motivation. The participating families were paid \$15 for the session.



### ***Procedure***

Children told one story with no story structure provided (free story tell) and one story with four pictures to provide some story structure (four picture story tell) during the second session of the second phase of the larger study. For the free story tell task the experimenter said, “I want you to make up a story, one that you have never heard before. You may have as long as you need to think it up. Tell me when you are ready. Please remember to say ‘the end’ when you are done.” For the four picture story tell the experimenter randomly laid out 4 cards each with a different word and clarifying picture of the word (e.g., the word “storm” was accompanied by a picture of a dark cloud with rain and lightning). The experimenter said, “I want you to make up a story you have not heard before. The story should be about a cave, a storm, gold, and a dragon. You may keep the cards to think up a story. Tell me when you are ready. Just like last time, please remember to say ‘the end’ when you are done with your story.” The child was given as much time as needed to complete the story.

The free story tell was conducted first to limit carryover effects based on the pictures into the second story. Children were seated across from an experimenter blind to the purpose of the study and the child’s diagnostic group. On the table between the child and experimenter was an audio recorder. A video camera was attached to an upper corner of the room to limit the distraction to the child. The free story tell and four picture story tell were recorded on audiotape and videotape.

### ***Story Representation Measures***

The free-story tell and four-picture story tell were transcribed verbatim from the recordings by undergraduate research assistants. Two trained coders read the stories and recorded the number of words and the grade level of the narrative (based on the Flesch-

Kincaid reading level). Each word was counted, except questions to the experimenter, references to the test, and self-regulatory language (e.g., “umm...uh”). The two coders parsed the narratives into story units (i.e., single ideas or events from the story). The narratives were then rated for story coherence, inclusion of a valid story, story complexity, and goal-based categories. Inter-rater reliability averaged above .80 on all coding categories analyzed in the study.

The narratives were rated for overall story coherence. The criteria for story coherence were measured by the correct use of connections (sentences that maintain the topic of the story), transitions (sentences that change the story topic to a new topic), and the completion of an entire thought or idea. The overall story coherence was rated on a four-point scale (1 = least coherent to 4 = most coherent). Inter-rater reliability for the coherence measure was .86.

The production of a goal-based narrative was measured to determine whether the child created a valid story and the overall story complexity. A valid story was defined as the inclusion of at least one GAO sequence. Thus, the stories were measured to determine whether the child produced a valid story (1) or did not (0). Story complexity was defined as the total number of GAO sequences. An overall GAO sequence must have an initiating event that either explicitly or implicitly establishes a goal, an attempt to resolve the goal, and an outcome that provides resolution of the goal (resolution can be successful or unsuccessful). The inter-rater reliability for the production of valid stories was .96 and for story complexity was .92.

The story grammar categories coded were the inclusion of a setting (place or time), protagonist (main character), additional characters (characters other than the protagonist), initiating events (sets up the overall goal), unlinked attempts (attempt or

action unrelated to the goal), linked attempts (attempt related to the goal), successful outcomes (positive resolution of the initiating event), failed outcomes (unsuccessful resolution of the initiating event), related events (events connected to the story), and unrelated events (events unconnected to the story). However, the present study focused on goal-based categories. Thus, only initiating events, unlinked attempts, linked attempts, successful outcomes, and failed outcomes were analyzed in the study. However, after coding the narratives, the unlinked and linked attempts were collapsed into an attempts category due to difficulty determining whether attempts were linked to the goal or not. Also, the failed outcomes category was removed from the analysis due to children's infrequent inclusion of failed outcomes (story grammar categories not analyzed in this study are defined in Appendix A). Stories that did not include an initiating event were not analyzed for the use of attempts or successful outcomes. The story grammar categories closely follow the procedures described by Trabasso and Nickels (1992), which follow the story grammar model (Stein & Glenn, 1979) and the causal network model (Trabasso, van den Broek, & Suh, 1989; van den Broek, 1990).

The *initiating event* set up the overall goal of the characters within the story. An initiating event was coded if the child provided a situation that needed to be resolved. A story could include several initiating events. A narrative with an initiating event will inherently contain a story goal (though it may be implicit). The initiating event was only included in the analysis if the story also contained an attempt and outcome related to the initiating event. The inter-rater reliability for initiating events was .89.

An *attempt* was an action that was either explicitly or implicitly connected to the goal. *Attempts* were only coded if the child's story included an initiating event. The inter-rater reliability for attempts was .88.

The *successful outcome* was the successful resolution of the desire or goal based on some action of the protagonist. A story could include several successful outcomes. A *successful outcome* was only coded if the child's story included an initiating event. The inter-rater reliability for successful outcomes was .89.

A 2 (younger, older) X 2 (ADHD, non-ADHD) analysis of variance (ANOVA) was conducted contrasting the patterns of difference between children with ADHD and comparison children. It is possible the differences between older children with ADHD and older comparison children in producing story representations are smaller in comparison to the differences between younger children with ADHD and younger comparison children. The contrasts started at the most general story measures and then moved to more specific goal-based categories. Thus, the analyses were completed in the order of: story coherence, production of valid stories, story complexity (based on the total number of GAO sequences), and the individual goal-based story grammar categories (initiating events, attempts and successful outcomes).

## Chapter Three

### Results

#### *Preliminary Analyses*

Prior to examining the narratives, performance on the Oral and Written Language Score (OWLS) was analyzed to assess whether there were group differences in the children's expressive language score. On average children with ADHD (92.92) scored lower than comparison children (106.09) on the expressive language section of the OWLS ( $F(1,273) = 46.306, p = .000, r = .38$ ). Although the groups differed in this expressive language measure, the 4-picture and free stories produced by children with ADHD and comparison children did not differ on the Flesch reading ease ( $F(1,275) = .315, p = .575$ ) or Flesch-Kincaid grade level ( $F(1,275) = .221, p = .638$ ) (see Table 1).

Comparison children told 4-picture and free stories with similar language complexity as measured by Flesch-Kincaid grade level ( $F(1,192) = .622, p = .431$ ), but children with ADHD told free stories with a higher language complexity than they did for the 4-picture story ( $F(1,83) = 4.433, p = .038, r = .23$ ). Thus, children with ADHD told stories with less complex language when provided some story structure.

All the narratives were examined for the length of story produced to determine if there were any group differences on the 4-picture and free story tell. Children with ADHD produced narratives with fewer words ( $F(1,145) = 16.876, p = .000, r = .32$ ), idea units ( $F(1,145) = 14.794, p = .000, r = .30$ ), and words per idea unit ( $F(1,145) = 17.959, p = .000, r = .33$ ) than comparison children when provided some story structure (4-picture story tell). Also, children with ADHD produced narratives with fewer words ( $F(1,126) = 6.773, p = .010, r = .23$ ), idea units ( $F(1,126) = 4.879, p = .029, r = .19$ ), and words per idea unit ( $F(1,123) = 10.760, p = .001, r = .28$ ) than comparison children when provided

Table 1 Group Means (and standard deviations) for language-based measures of narratives on the 4-picture and free story tell

Story	Category	ADHD	Comparison
4-Picture			
	Flesch Reading Ease	84.96 (14.33)	83.72 (14.02)
	Flesch-Kincaid Grade Level	4.99 (2.59)	5.61 (2.86)
Free			
	Flesch Reading Ease	78.80 (15.20)	82.30 (10.57)
	Flesch-Kincaid Grade Level	6.27 (3.00)	5.90 (2.21)

no story structure (free story tell) (see Table 2). Children with ADHD produced 4-picture stories that had a trend to consist of fewer words than the free stories produced by children with ADHD ( $F(1,83) = 3.394, p=.069$ ) but comparison children told 4-picture and free stories with a similar number of words ( $F(1, 192) = .132, p = .717$ ). When expressive language was taken into account, the group story length difference remained significant for the number words ( $F(1,143) = 11.965, p=.001, r=.28$ ), number of idea units ( $F(1,143) = 10.775, p=.001, r=.26$ ) and the number of words per idea unit ( $F(1,143) = 10.283, p=.002, r=.26$ ) on the 4-picture story, and remained marginally significant for the number of words ( $F(1,124) = 3.179, p=.077, r=.16$ ) and words per idea unit ( $F(1,124) = 3.304, p=.072, r=.16$ ) on the free story. Thus, children with ADHD told shorter stories than comparison children, but the group difference could not be accounted for by the difference in expressive language skills when children were provided some story structure.

### ***Overview of Analyses***

The narratives were analyzed in five steps. First, the narratives were analyzed to determine if there was a group difference in the story coherence. Second, the frequency of children meeting the criterion of telling a valid story in the narrative was analyzed. Third, the story complexity (as the total number of goal-attempt-outcome (GAO) sequences) in the narratives was analyzed. Fourth, the frequency of separate goal-based categories in the narratives was analyzed. Fifth, the narratives were analyzed for any developmental differences in story coherence, production of a valid story, story complexity, and all goal-based categories.

Each step in the analysis first was conducted without covariates in the analysis. Second, the diagnostic group differences noted in the Preliminary Analysis were

Table 2 Group Means (and standard deviations) for story-length categories on the 4-picture and free story tell

Story	Category	ADHD	Comparison
4-Picture			
	Words	70.91 (49.47)	160.70 (157.64)
	Idea Units	11.33 (7.29)	21.62 (18.99)
	Words per Idea Unit	5.99 (1.36)	7.12 (1.60)
Free			
	Words	105.60 (114.96)	168.49 (138.66)
	Idea Units	15.38 (15.85)	22.28 (17.36)
	Words per Idea Unit	6.42 (1.46)	7.29 (1.39)



addressed by considering expressive language (OWLS as a covariate) or story length (as a proportion of the story category of interest to the total number of idea units). The analyses began at the level of the most general questions and then moved to questions about more specific goal-based categories.

### ***Group differences on story coherence***

The most global factor that could impair a story representation was the story coherence. Children with ADHD have demonstrated difficulties telling coherent free recalls, but only when attention was distracted (Flake et al., 2007). In the current study, the coherence scale measured the overall flow, story connections, and transitions of each story. Children with ADHD produced narratives that were rated to be less coherent, whether the child was given some or no story structure and above and beyond expressive language differences. Children with ADHD told less coherent stories ( $M = 1.89$ ) than comparison children ( $M = 2.50$ ) on the 4-picture story ( $F(1,145) = 15.725$ ,  $p = .000$ ,  $r = .31$ ) and less coherent stories ( $M = 1.95$ ) than comparison children ( $M = 2.66$ ) on the free story ( $F(1,126) = 14.472$ ,  $p = .000$ ,  $r = .32$ ). The group difference remained when expressive language was entered as a covariate, both on the 4-picture story ( $F(1,143) = 5.663$ ,  $p = .019$ ,  $r = .19$ ) and on the free story ( $F(1,124) = 6.445$ ,  $p = .012$ ,  $r = .22$ ).

### ***Group differences on telling a valid story***

Problems with story coherence may mean children with ADHD have trouble creating a story representation with at least one GAO sequence. The inclusion of at least one GAO sequence in the narrative sets up a goal plan, which is essential in telling a story (Trabasso, Stein, Rodking, Munger, & Baughn, 1992). Thus, telling a valid story was defined as a story representation containing at least one goal-attempt-outcome (GAO) sequence. This was a dichotomous variable in which the child either did or did

not tell a valid story. Children with ADHD told a lower proportion of valid stories whether given some or no story structure. Children with ADHD told a lower proportion of valid stories (.38) than comparison children (.58) on the 4-picture story ( $F(1,145) = 6.534, p = .012, r = .21$ ) and a lower proportion of valid stories (.33) than comparison children (.61) on the free story ( $F(1,126) = 10.564, p = .001, r = .29$ ). The group difference remained for the free story after accounting for expressive language ( $F(1,124) = 6.254, p = .014, r = .22$ ) but was not significant for the 4-picture story after accounting for expressive language ( $F(1,143) = .390, p = .533$ ). Overall, children with ADHD had difficulty telling a valid story when provided some or no story structure. This difference remained above and beyond expressive language differences only when children were provided no story structure.

### ***Group differences on story complexity***

The problems children with ADHD have telling a coherent story also may be due to differences in the total number of GAO sequences in the story they tell. Narratives with more GAO sequences have been found to be more complex (Stein & Albro, 1997) and provide the opportunity for the narrator to create transitions and connections in the story. The correct use of these additional transitions and connections could offer some explanation to the group differences in the production of coherent narratives. Story complexity was defined as the total number of GAO sequences in the story representation. Thus, telling a story with many GAO sequences suggests the child understands the importance of GAO sequences within a story representation. Children with ADHD told narratives with fewer GAO sequences when given some or no story structure (see Table 3). Children with ADHD told narratives with fewer GAO sequences on the 4-picture ( $F(1,145) = 7.176, p = .008, r = .22$ ) and free story ( $F(1,126) = 7.406, p =$

Table 3 Group means (and standard deviations) for story complexity on the 4-picture and free story tell

Story	Category	ADHD	Comparison
4-Picture			
	Total GAO sequences	.62 (.89)	1.08 (1.15)
	Proportion of GAO sequences **	.03 (.05)	.05 (.05)
Free			
	Total GAO sequences	.53 (1.06)	1.14 (1.29)
	Proportion of GAO sequences	.02 (.04)	.04 (.05)

\*\* Not Significant ( $p > .05$ )

.007,  $r = .24$ ) than comparison children. The group difference remained marginally significant on the free story tell after controlling for expressive language ( $F(1,124) = 3.089$ ,  $p = .081$ ,  $r = .16$ ), but was not significant on the 4-picture story tell after controlling for expressive language ( $F(1,143) = 1.224$ ,  $p = .271$ ). The difference remained when story length was taken into account and no story structure was provided, ( $F(1,126) = 6.626$ ,  $p = .011$ ,  $r = .22$ ), but did not differ when some story structure was provided, ( $F(1,145) = 1.943$ ,  $p = .165$ ). Overall, children with ADHD told narratives with fewer GAO sequences when provided some or no story structure. This difference was not accounted for by differences in expressive language or story length when no story structure was provided.

#### ***Group differences on goal-based categories***

The problems with story coherence, telling a valid story, and story complexity may be due to differences in telling stories that include specific goal-based categories. Children with ADHD have demonstrated difficulties telling stories with specific goal-based categories on an on-line narration task (Renz et al., 2003; Flory et al., 2006). In the present study the goal-based categories measured were initiating events, attempts, and successful outcomes. Children with ADHD may have trouble with one specific goal-based category necessary for a story representation or may have trouble with all goal-based categories. In the present study, children with ADHD told stories with fewer goal-based categories and a lower proportion of some of the goal-based categories when provided some or no story structure (See Table 4).

#### ***Group differences in the production of initiating events***

Children with ADHD told stories with fewer initiating events both when some story structure was provided,  $F(1,145) = 7.115$ ,  $p = .009$ ,  $r = .22$ , and when no story

Table 4 Group Means (and standard deviations) for goal-based categories on the 4-picture and free story tell

Story	Category	ADHD	Comparison
4-Picture			
	Initiating Events	.49 (.70)	.94 (1.16)
	Attempts	1.27 (2.00)	2.83 (3.36)
	Successful Outcomes	.62 (.94)	1.05 (1.15)
	Proportion of Attempts	.07 (.10)	.11 (.09)
Free			
	Initiating Events	.43 (.87)	.90 (1.03)
	Attempts	1.30 (3.10)	2.41 (2.61)
	Successful Outcomes	.48 (.82)	1.13 (1.18)
	Proportion of Initiating Events	.02 (.03)	.03 (.04)
	Proportion of Successful Outcomes	.02 (.03)	.05 (.05)

structure was provided,  $F(1,126) = 6.921$ ,  $p = .010$ ,  $r = .23$ . This difference remained nearly significant when differences in expressive language were taken into account when no story structure was provided,  $F(1,124) = 3.541$ ,  $p = .062$ ,  $r = .17$  and there was a slight trend when some story structure was provided,  $F(1,143) = 2.750$ ,  $p = .099$ ,  $r = .14$ . The difference also remained when story length was taken into account when no story structure was provided,  $F(1,126) = 5.217$ ,  $p = .024$ ,  $r = .20$ . The less frequent use of initiating events limits the establishment of the goal portion of GAO sequences.

### ***Group differences in the production of attempts***

Children with ADHD told stories with fewer attempts both when some story structure was provided,  $F(1,145) = 9.727$ ,  $p = .002$ ,  $r = .25$ , and when no story structure was provided,  $F(1,126) = 4.748$ ,  $p = .031$ ,  $r = .19$ . This difference remained when expressive language differences were taken into account when some story structure was provided,  $F(1,143) = 4.126$ ,  $p = .044$ ,  $r = .17$ , but not when story structure was not provided,  $F(1,124) = 2.688$ ,  $p = .104$ . The difference remained when story length was taken into account and some story structure was provided,  $F(1,145) = 7.042$ ,  $p = .009$ ,  $r = .22$ . The less frequent use of attempts limits addressing the goal that results in a story outcome.

### ***Group differences in the production of successful outcomes***

Children with ADHD told stories with fewer successful outcomes both when some story structure was provided,  $F(1,145) = 6.648$ ,  $p = .011$ ,  $r = .21$ , and when no story structure was provided,  $F(1,126) = 10.737$ ,  $p = .001$ ,  $r = .28$ . This difference remained when expressive language differences were taken into account when no story structure was provided,  $F(1,124) = 6.326$ ,  $p = .013$ ,  $r = .22$ . The difference also remained when story length was taken into account and no story structure was provided,  $F(1,126) = 11.387$ ,  $p$

=.001,  $r = .29$ . The less frequent use of successful outcomes limits the resolution of a story goal.

Overall, children with ADHD had difficulty using specific goal-based categories that create the GAO sequences when creating their own story representation when provided some or no story structure. These differences remained on the initiating events and successful outcomes above and beyond expressive language differences when no story structure was provided but only on attempts when some story structure was provided. In addition, children with ADHD told stories with a lower proportion of initiating events and successful outcomes when no story structure was provided and stories with a lower proportion of attempts when some story structure was provided.

### ***Developmental group age differences***

In addition to group diagnosis differences, the present study addressed whether any developmental differences between younger and older children existed. Past research has found group age differences in the production of goal-based measures within a story (Trabasso & Stein, 1997; Freer, Riley, Lorch & Milich, 2007). Consistent with this research, significant differences between older and younger children were present in both diagnosis groups on all the story representation measures (Table 5). Older children produced 4-picture story tells with significantly greater story coherence, more frequent production of valid stories, greater story complexity, more initiating events, more attempts, and more successful outcomes than younger children. Older children produced free stories with significantly more frequent production of valid stories, greater story complexity, more initiating events, more attempts, and more successful outcomes. In addition, there was a marginally significant age effect for story coherence on the free story tell. However, no age X diagnosis interaction was significant for any of the story

Table 5 Developmental Group Means (and standard deviations) for story coherence, story complexity, and goal-based categories on the 4-picture and free story tell

Story	Category	Children with ADHD		Comparison Children	
		Younger	Older	Younger	Older
4-Picture	Story Coherence	1.70 (.88)	2.09 (.92)	2.13 (.95)	2.94 (.84)
	Valid Story	.26 (.45)	.45 (.51)	.39 (.49)	.79 (.41)
	Story Complexity	.39 (.72)	.82 (1.01)	.66 (1.01)	1.56 (1.13)
	Initiating Events	.26 (.45)	.73 (.83)	.61 (1.06)	1.33 (1.17)
	Attempts	1.04 (1.92)	1.50 (2.11)	1.93 (2.85)	3.88 (3.64)
	Successful Outcomes	.35 (.71)	.91 (1.06)	.57 (.85)	1.60 (1.22)
Free	Story Coherence	1.90 (.97)	2.00 (1.03)	2.29 (.99)	3.02 (.94)
	Valid Story	.20 (.41)	.45 (.51)	.44 (.50)	.78 (.42)
	Story Complexity	.20 (.41)	.85 (1.39)	.84 (1.38)	1.44 (1.14)
	Initiating Events	.20 (.41)	.65 (1.14)	.60 (.99)	1.20 (.99)
	Attempts	.65 (1.39)	1.95 (4.11)	1.62 (2.48)	3.20 (2.52)
	Successful Outcomes	.25 (.44)	.70 (1.03)	.84 (1.24)	1.42 (1.06)



representation measures. Thus, the pattern of difference between younger and older children was not different based on diagnosis for story coherence, production of a valid story, story complexity, initiating events, attempts, or successful outcomes (see inferential statistics in Appendix B).

### ***Group differences in the valid stories produced***

As reported earlier, children with ADHD told fewer valid stories (narrative containing at least one GAO sequence) than comparison children. The group differences on specific goal-based categories found in the present study could be due to the difficulty children with ADHD had telling valid stories. Children with ADHD produced 17 valid stories and comparison children produced 60 valid stories when some story structure was provided. Children with ADHD produced 13 valid stories and comparison children produced 55 valid stories when no story structure was provided. Thus, post-hoc analyses were conducted to determine if there were any group differences in story coherence, story complexity, or the use of goal-based categories for the valid stories told by children with ADHD and comparison children.

There was one significant difference in the valid stories produced by children with ADHD and comparison children. Children with ADHD told less coherent valid stories than comparison children when no story structure was provided ( $F(1,64) = 8.420, p=.005, r=.34$ ). In addition, due to the small sample of children with ADHD telling a valid story, the group means will be examined to determine if there appear to be any group differences for valid stories on the 4-picture story tell (see Table 6) and the free story tell (see Table 7) as compared to the invalid stories (story without a GAO sequence). Story complexity was not analyzed for invalid stories because story complexity was measured as the total number of GAO sequences and by definition an invalid story has no GAO

Table 6 Group Means (and standard deviations) for story coherence, story complexity, and goal-based categories for valid stories only and all stories on the 4-picture story tell

Category	Type of Story	ADHD	Comparison
Coherence	Valid Stories Only	2.71 (.85)	2.97 (.74)
	Invalid Stories	1.41 (.50)	1.86 (.93)
Complexity	Valid Stories Only	1.65 (.61)	1.87 (.91)
	Invalid Stories	NA	NA
Initiating Events	Valid Stories Only	1.29 (.47)	1.63 (1.10)
	Invalid Stories	NA	NA
Attempts	Valid Stories Only	3.12 (2.15)	4.50 (3.50)
	Invalid Stories	.17 (.60)	.55 (1.04)
Successful Outcomes	Valid Stories Only	1.47 (1.01)	1.65 (1.09)
	Invalid Stories	.10 (.31)	.23 (.60)

\* Significant ( $p < .05$ )

Table 7 Group Means (and standard deviations) for story coherence, story complexity, and goal-based categories for valid stories only and all stories on the free story tell

Category	Type of Story	ADHD	Comparison
Coherence	Valid Stories Only*	2.46 (.87)	3.15 (.80)
	Invalid Stories	1.70 (.95)	1.89 (.87)
Complexity	Valid Stories Only	1.62 (1.33)	1.87 (1.17)
	Invalid Stories	NA	NA
Initiating Events	Valid Stories Only	1.31 (1.11)	1.47 (.94)
	Invalid Stories	NA	NA
Attempts	Valid Stories Only	3.62 (4.70)	3.87 (2.34)
	Invalid Stories	.19 (.48)	.11 (.47)
Successful Outcomes	Valid Stories	1.38 (.87)	1.65 (1.21)
	Invalid Stories*	.04 (.19)	.31 (.47)

\* Significant ( $p < .05$ )

sequences. Initiating events were not analyzed for invalid stories because an idea unit was coded as an initiating event only if an attempt and outcome were also coded in the story, which by definition is a GAO sequence. All children produced invalid stories with less coherence, fewer attempts, and fewer successful outcomes than valid stories regardless of type of story or group. Children with ADHD produced invalid stories with fewer successful outcomes than comparison children. Invalid stories were characterized as shorter stories with fewer goal-based events resulting in a proportionately larger number of events and setting statements than valid stories (an example of a prototypical valid story is provided in Appendix C and an example of a prototypical invalid story is provided in Appendix D).

***Differences between younger comparison children and older children with ADHD***

To better understand the developmental aspects of the group differences found in this study for coherence, proportion of valid stories, story complexity, and goal-based categories; the narratives produced by older children with ADHD and younger comparison children were analyzed to determine if any differences were present. Past research has found specific developmental changes in children's story narrations and the use of goal-based categories (Trabasso & Stein, 1997; Freer, Riley, Lorch, & Milich, 2007). If differences do not exist, this would suggest children with ADHD are not closing the gap between themselves and comparison children in developing an understanding of the importance of goals within a story. In the present study, older children with ADHD and younger comparison children did not differ in their production of coherent, goal-based narratives (Table 8). Older children with ADHD and younger comparison children told stories with similar coherence, proportion of valid stories, complexity and all goal-based categories when provided some or no story structure.

Table 8 Group Means (and standard deviations) for story coherence, valid stories, story complexity and goal-based categories by younger comparison children and older children with ADHD on the 4-picture and free story tell

Story	Category	Older ADHD	Younger Comparison
4-Picture			
	Coherence	2.09 (.92)	2.13 (.95)
	Valid Story	.50 (.51)	.39 (.49)
	Complexity	.86 (.99)	.66 (1.01)
	Initiating Events	.73 (.83)	.61 (1.06)
	Attempts	1.50 (2.11)	1.93 (2.85)
	Successful Outcomes	.91 (1.07)	.57 (.85)
Free			
	Coherence	2.00 (1.03)	2.37 (.99)
	Valid Story	.45 (.51)	.49 (.51)
	Complexity	.85 (1.39)	.93 (1.42)
	Initiating Events	.65 (1.14)	.66 (1.02)
	Attempts	1.95 (4.11)	1.73 (2.56)
	Successful Outcomes	.70 (1.03)	.93 (1.27)

## **Chapter Four**

### **Discussion**

The findings of the present study add to the growing literature on story comprehension abilities in children with ADHD by identifying the difficulties these children have creating their own coherent, goal-based story representations and maintaining their goal plan throughout the story. The present study revealed several important difficulties experienced by children with ADHD when given some or no story structure. First, children with ADHD told shorter stories. Second, children with ADHD produced less coherent narratives. Third, children with ADHD had difficulty maintaining a goal plan during the narrative, as evidenced by a lower proportion of valid stories, less complex stories, and less use of all aspects of the GAO sequence. Fourth, children with ADHD told less coherent valid stories than comparison children when given no story structure. Fifth, older children with ADHD and younger comparison children told stories with similar coherence, proportion of valid stories, complexity, and all goal-based categories when provided some or no story structure.

There are some indications that children with ADHD were aided by some story structure. This finding is consistent with the study by Lorch, Sanchez et al. (1999) that found when attention was focused on the story comprehension task children with ADHD and comparison children both benefit from causal structure when recalling a TV story. Children with ADHD told stories with a similar proportion of initiating events and successful outcomes as comparison children when some story structure was provided. In addition, children with ADHD told valid stories of similar coherence to comparison children when given some story structure but told less coherent valid stories than comparison children when no story structure was provided. Also, when expressive

language was taken into account, children with ADHD told a similar proportion of valid stories, stories with similar complexity, and a similar number of initiating events and successful outcomes as comparison children when some story structure was provided. However, when no story structure was provided and expressive language was taken into account, children with ADHD told a lower proportion of valid stories, stories with less complexity, and fewer initiating events and successful outcomes. The provision of some story structure to children with ADHD may limit the amount of story information needed to be remembered, which lowers the demands on working memory and allows more cognitive processes to be devoted to the creation of a story representation.

In addition, children with ADHD told shorter stories when given some story structure than when given no story structure. In this case the story structure still may aid children with ADHD by preventing these children from losing focus of the goal plan and correctly finishing the story. This finding is consistent with the findings of Zentall (1988). In addition, because the four pictures are present throughout the story tell, children with ADHD may tell shorter stories because they view the task as completed once they have included the 4-pictures in their story representation. However, children with ADHD produced stories with more GAO sequences and goal-based categories when provided some story structure, suggesting the four pictures provide focus and not inappropriate resolution of the story.

The finding that children with ADHD told shorter stories when given some story structure than when given no story structure, but created story representations more similar to comparison children when given some story structure than when given no story structure suggests children with ADHD were displaying deficits in skill and not effort. If deficits in effort were responsible for the difficulties demonstrated creating a story

representation then one would expect shorter stories with an equal proportion of GAO sequences and goal-based categories as when given no story structure. However, if deficits in skill explain the difficulties creating a story representation then one would expect providing some story structure would offer a supplement to the skills necessary for creating a story representation, such as sustaining attention, planning, and working memory. Thus, the present study supports an explanation of deficits in the skills necessary to create a story representation rather than a problem in the effort put forth on the story telling tasks.

This is the first study to qualitatively assess the difficulties children with ADHD have creating a coherent, goal-based story representation. The group differences found extend the knowledge of the difficulties children with ADHD have recalling and creating story representations. This study provides a new insight into children with ADHD's understanding of the importance of a goal plan within a story because the children were required to create their own goal plan as opposed to past tasks that required a child to recall a story's goal plan they read, heard, or watched or based on a series of pictures that imply a goal plan (on-line narration task). The results are consistent with the findings of Renz et al. (2003) and Flory et al. (2006), although these studies investigated the production of on-line narratives based on wordless picture books.

The group differences in story coherence, story complexity, and goal-based categories could be explained by the infrequent telling of a valid story by children with ADHD. The present study also analyzed the valid stories only to determine if group differences remained in children that included at least one GAO sequence. Children with ADHD produced less coherent valid stories than comparison children when given no story structure. Children with ADHD and comparison children had no other significant



group differences on either story telling task. However, very few children with ADHD told valid stories which greatly limited the power of the analysis. Despite no other significant group differences, children with ADHD told valid stories with less complexity and fewer total goal-based categories on both story telling tasks and rated as less coherent on the 4-picture story tell than comparison children. This finding of group differences in story coherence when no structure was given provides additional evidence children with ADHD benefitted from some story structure when creating a story representation. Children with ADHD may have had more trouble producing a goal plan when given no story structure which resulted in the production of less coherent narratives. This suggests the need for academic settings to provide interventions that focus children with ADHD on the importance of creating a goal plan. In addition, this finding suggests the need to teach children with ADHD to write down their goal plan and refer to it when creating a story representation.

Older children with ADHD and younger comparison children produced stories with similar story coherence, proportion of valid stories, story complexity, and all goal-based categories on both story telling tasks. This finding reveals evidence that children with ADHD are not closing the gap with comparison children in the creation of story representations with goal-based categories. It is possible children with ADHD will continue to improve and will perform similarly to comparison children in the production of coherent, goal-based stories at an older age. Or, the gap between children with ADHD and comparison children may increase. A future study should longitudinally assess children with ADHD and comparison children in the creation of a story representation to determine the developmental factors that contribute to the deficits demonstrated by children with ADHD in the present study. The current study suggests children with

ADHD need additional instruction in academic settings focusing on the importance of a goal plan to increase performance on story comprehension and creating story representations.

There are several possible reasons children with ADHD had more difficulties than comparison children creating a story representation, and most likely these possible explanations interact resulting in overall poor production of a coherent, goal-based story representation. First, children with ADHD may have problems sustaining attention to the story telling task. Difficulty sustaining attention has been found to be the most influential mediator in accounting for group differences in the production of on-line narratives (Flory et al., 2006). Difficulty consistently attending to the story representation may hinder focus on maintaining the goal plan that would prevent the completion of GAO sequences. The problem children with ADHD had telling shorter stories provide some evidence of this difficulty sustaining attention. The possibility that these group differences are due to difficulties with sustained attention raises the issue of whether stimulant medication may improve the performance of children with ADHD in producing a coherent, goal-based story representation. Additionally, specific instruction may be necessary to increase focus of children's attention on the importance of the establishment of goals and the relation of those goals to the sequence of events ending in an outcome.

A second possible reason children with ADHD had more difficulties creating a story representation than comparison children is that they have a difficulty with executive functions, namely planning and working memory. One current theory argues that problems children with ADHD have in academic domains, such as story comprehension, are due primarily to these deficits in executive function (Barkley, 1997; Nigg, 2001). In support of this theory, children with ADHD have demonstrated several deficits in

working memory (Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005). Difficulty planning the story representation or utilization of working memory may hinder the use of a goal plan that would prevent the completion of GAO sequences and use of initiating events, attempts, and successful outcomes. A deficit in planning may explain this occurrence because these children may not have determined a goal plan for the story. Or, a deficit in working memory may explain this occurrence because it may prevent the child from keeping track of their goal plan which would result in the difficulty producing complete, coherent story representations to memory. Thus, the child may have problems connecting the end of the story to the beginning of the story. These problems with planning and working memory may also explain the creation of less coherent story representations by children with ADHD. These executive function deficits would require different interventions for children with ADHD than if deficits in sustaining attention explain the group differences found in this study. Deficits in executive function suggest the need for specific intervention to teach children with ADHD the importance of creating an overall goal plan in a story representation and maintaining the goal plan throughout the story representation. This could be accomplished by requiring children with ADHD to write down the sequence of events for the overall goal plan and to refer to this goal plan while telling the story. This would create a task similar to the on-line narration task using a wordless picture book, during which children with ADHD have demonstrated deficits (Renz et al., 2003; Flory et al., 2006), but would have one important distinction. In the on-line narration tasks of these studies, children could not look back at past pages to assist creating the story representation, but the child's goal-plan could be referred to during the creation of the story representation. This could decrease the demands on working memory during the story telling task.

A third possible reason children with ADHD had more difficulties creating a story representation than comparison children is that they may have more difficulty understanding the importance of a goal plan. Children with ADHD have demonstrated worse understanding of information important to the overall goal than comparison children in recall tasks (Lorch, Milich, Astrin, & Berthiaume, 2006). If children with ADHD have a poorly developed understanding of essential story structure then this would explain the production of stories with fewer important goal-based story components and fewer GAO sequences. This poor understanding of story structure may explain why children with ADHD performed more similarly to comparison children when some story structure was provided. A future study could determine if children with ADHD differ from comparison children in the understanding of story structure by utilizing a task that requires children to read, listen, or watch a story and identify goal-based components and GAO sequences within the story. If group differences occur in the understanding of story structure, academic settings should focus instruction on what story structure is, how story structure is important, and assigning tasks to students that reinforce the need for goals, attempts, and outcomes.

A fourth possible reason children with ADHD had more difficulties creating a story representation could be overall quantitative production deficiencies. In the present study, children with ADHD told marginally longer stories when no story structure was provided than when some story structure was provided, but produced stories with a similar number of goal-based categories. Thus, the longer free stories may have additional unnecessary information that was not included when some story structure was provided to guide the story representation. This finding replicates a past finding of

production deficiencies on the free story and 4-picture story task by children with ADHD (Zentall, 1988).

### ***Limitations and Future Directions***

First, the study recruited children with ADHD from clinic and community samples and comparison children from community samples. This may have resulted in a community sample not matched well to children with ADHD on all demographics. Another possible sampling limitation is that children's behavior was only rated by parents and no teachers were interviewed to confirm behavioral information collected. This may have resulted in the inclusion of children in the ADHD group that did not reach the DSM-IV definition. However, it is unlikely any children were incorrectly placed in the ADHD group because children also had been given a clinical diagnosis.

A second limitation and possible future direction of research, was that the study does not allow a clear explanation of why children with ADHD differed from comparison children on coherence, GAO, and goal-based measures. The study demonstrates that children with ADHD have deficits in creating a story representation, but does not explain why this deficit exists. A future study could address the reason this deficit exists utilizing a similar methodology to Flory et al. (2006) when telling a story with some and no story structure provided. This future study would examine the mediators of group differences in story narrations between children with ADHD and comparison children to determine which of the core deficits of ADHD or verbal skills accounts for the most variance in group differences. This future study would require all children to create a story representation when given some and no story structure. In addition, all children would complete tasks measuring the core deficits of ADHD and verbal skills to determine the deficit with the largest impact on the creation of a story representation.

A third limitation of the study is the order effect of the story telling tasks. In the present study, all children first completed the free story task followed by the 4-picture story task. This could have resulted in a fatigue or boredom effect that could explain the 4-picture story being shorter for children with ADHD. Or, there could have been a practice effect that could explain why children with ADHD told stories more similar to comparison children for coherence, GAO, and goal-based measures when expressive language or story length was taken into account. A future study could address both order effects by having children tell one story on two separate visits to the research setting. The story telling task could then be counterbalanced or the study could still keep the same order of tasks but the time between tasks could reduce these order effects.

A fourth limitation of the study is the low number of children with ADHD telling valid stories. The group differences on specific variables found in the present study may have been the result of the low number of valid stories produced. Thus, a future study should investigate valid stories of children with ADHD and comparison children to determine if group differences on story coherence, story complexity, and goal-based categories remain. This study would provide additional insight into children's creation of a story representation. If children with ADHD tell valid stories that are similar to comparison children then future research and interventions should focus on the importance of the inclusion of a GAO sequence. However, if children with ADHD tell valid stories that are significantly different than comparison children then future research must address two areas. First, research and interventions would need to focus on the inclusion of a GAO sequence. Second, research would need to focus on why children with ADHD struggle with the elaboration of GAO sequences and goal-based categories even when including at least one GAO sequence.

The deficits demonstrated by children with ADHD in the present study suggest two more interesting paths for future research. First, intervention studies should be investigated to determine how academic settings can best teach children with ADHD to create a coherent, goal-based story representation. For example, children could use a worksheet that would focus on the GAO sequence. The worksheet would require the child to recognize the initiating events, goals, character attempts to resolve the goal, and the story outcome. The worksheet could be used to recognize goal-based categories when the child read stories or to assist the child in the creation of their own story. Second, a study should investigate whether these story representation deficits remain when children with ADHD are treated with medication. In the present study, no children were allowed to participate if they had taken their medication for ADHD that day.

In summary, the findings of the present study provide initial evidence of the deficits children with ADHD have creating their own story representation in contrast to comparison children. Specifically, children with ADHD tell fewer valid stories and create story representations with less coherent, less complex, and that include fewer goal-based categories when provided no story structure or some story structure. This suggests the deficits children with ADHD have understanding stories is not limited to recall or creating stories with a wordless picture book. The study also suggests the difficulty creating a story representation is a skill-based deficit and not a deficit in effort for children with ADHD. In addition, the study reveals older children with ADHD and younger comparison children told stories that looked similar in measures of coherence, proportion of valid stories, complexity, and goal-based categories. The findings add to the knowledge of the differences in processing of higher-order cognitive tasks of children with ADHD and comparison children. The results suggest the need for specific academic

interventions to focus attention to the importance of a goal plan for story comprehension and creating a story representation.



## Appendix A

### Additional Story Grammar Category Definitions

The *setting* was the place or time the story takes place. This created the background of the story.

The *protagonist* was the character the story revolves around. This character was involved in the initiating event, attempts, and outcome of the story.

The *additional characters* were all the characters within the story other than the protagonist.

The *unlinked attempt* was an action not explicitly connected to the goal because there was no mention or connection to the goal. An *unlinked attempt* was coded if the child explained actions but did not connect them to characters or the goal.

The *linked attempt* was an action explicitly connected to the goal of the story. A *linked attempt* was coded if the child explained actions while connecting them to characters or the goal.

The *failed outcome* was an unsuccessful resolution of the desire or goal based on some action of the protagonist. A *failed outcome* was only coded if the child's story included an initiating event.

A *related event* was an event connected to the story. A *related event* was coded if the child made a statement connected to the story that provided additional relevant information to the story.

An *unrelated event* was an event not connected to the story. An *unrelated event* was coded if the child made a statement not connected to the story that provided no additional relevant information to the story.

## Appendix B

### Inferential Statistics of Developmental Differences

Older children produced 4-picture stories with significantly greater story coherence ( $F(1,143) = 12.959, p = .000, r = .29$ ), more frequent production of valid stories ( $F(1,143) = 11.759, p = .001, r = .28$ ), greater story complexity ( $F(1,143) = 12.946, p = .000, r = .29$ ), more initiating events ( $F(1,143) = 10.727, p = .001, r = .26$ ), more attempts ( $F(1,143) = 5.001, p = .027, r = .18$ ), and more successful outcomes ( $F(1,143) = 19.367, p = .000, r = .35$ ) than younger children. However, there was no significant interaction on the 4-picture story tell for story coherence ( $F(1,143) = 1.881, p = .172$ ), production of a valid story ( $F(1,143) = 1.600, p = .208$ ), story complexity ( $F(1,143) = 1.884, p = .172$ ), initiating events ( $F(1,143) = .591, p = .443$ ), attempts ( $F(1,143) = 2.148, p = .145$ ), or successful outcomes ( $F(1,143) = 1.914, p = .169$ ).

Older children produced free stories with significant more frequent production of valid stories ( $F(1,117) = 10.679, p = .001, r = .29$ ), greater story complexity ( $F(1,117) = 6.518, p = .012, r = .23$ ), more initiating events ( $F(1,117) = 7.346, p = .008, r = .24$ ), more attempts ( $F(1,117) = 8.886, p = .003, r = .27$ ), and more successful outcomes ( $F(1,117) = 5.240, p = .024, r = .21$ ). Older children produced free stories with a marginally significant age effect for story coherence ( $F(1,117) = 3.664, p = .058, r = .17$ ). However, there was no significant interaction of the free story tell for story coherence ( $F(1,117) = 1.875, p = .174$ ), production of a valid story ( $F(1,117) = .000, p = .997$ ), story complexity ( $F(1,117) = .145, p = .704$ ), initiating events ( $F(1,117) = .003, p = .957$ ), attempts ( $F(1,117) = .002, p = .966$ ), and successful outcomes ( $F(1,117) = .004, p = .950$ ).

## Appendix C

### Example of a Prototypical Valid Story

Once there was a little hamster, and his name was Zig. Zig had one brother, and when they were at the pet store, and his brother's name was Thomas. Thomas and Zig always played with each other. But one day somebody came and took Thomas away. So Zig thought that nobody liked him, so he tried, he kept every single day he thought of a way that he could get out. And the next day that the person that owned the place always thought that he had something wrong with him. So she took him, the hamster Zig to the vet. And the vet said that there's nothing with him, he's just a little feisty. And Zig was kind of, Zig didn't know what that meant so Zig was kind of angry, so Zig bit the person's finger. And, Zig, and she dropped Zig to the floor. And Zig ran as fast as he could to the door and he hid in the corner. So he was thinking, while he was in the corner, he said, "I think I will just wait till the door opens so I can go out." And when he, and when the door opened he saw a person with a cage. With another little hamster in it. And then the person in the kit, that little hamster in it said "ZIG!" and then he looked up and said "Thomas!" and then, Zig followed Thomas to where he was going. So when they took Zig, Thomas out, Thomas bit the person's finger. And then after that they made a little home in the wall, and they lived happily ever after.

## Appendix D

### Example of a Prototypical Invalid Story

The fox went to the market to buy his wife something for mother's day, and what he got her was 14 karat gold earrings. And when he came back, his wife was gone to get something for father's day. Father's day was the next day after, and when she got back she found the 14 karat gold earrings, and then she went out to eat. And then, he came back and seen the present that she got her for him for father's day, and it was a new watch.

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## Vita

Benjamin D. Freer  
Born: 4/23/83 in Lexington, KY

### **Education**

University of Kentucky, Master's Degree  
Program: Cognitive/Developmental Psychology      August, 2005-Present

Valparaiso University, B.S.  
Major: Psychology      August, 2001-May, 2005

### **Professional Positions Held**

Research Assistant, University of Kentucky      August, 2005-Present

Teaching Assistant, University of Kentucky      August, 2005-July, 2006

### **Scholastic and Professional Honors**

#### **Fellowships**

Research Challenged Trust Fund,  
Department of Psychology      July, 2006-June, 2007

#### **Honors**

Christ College (Honors College)      August, 2001-May, 2005

NCAA "Stay In Bounds" recipient      August, 2003-May, 2004

### **Conference Posters**

Freer, B.D., Little, S., Metze, A., Milich, R., & Lorch, E.P. (2008) *The Effectiveness of Formulating a Story Representation among Children with Attention Deficit Hyperactivity Disorder and Comparison Children*. Poster to be presented at Conference on Human Development, Indianapolis, IN.

Lorch, E.P., Freer, B.D., Hodell, E.C., Dunlap, E.E., Calderhead, W.J., & Lorch, R.F. *Thinking aloud interferes with application of the control of variables strategy*. Poster to be presented at American Educational Research Association, New York, NY.

Lorch, R.F., Calderhead, E.J., Dunlap, E.E., Hodell, E.C., Freer, B.D., & Lorch, E.P.

*Teaching the control of variables strategy in fourth grade classrooms.* Poster to be presented at American Educational Research Association, New York, NY.

Freer, B.D., Riley, E., Lorch, E.P., & Milich, R. (2007) *Developmental Changes in Children's Goal-Based Story Representation.* Poster presented at Society for Research in Child Development, Boston, MA.

Freer, B., Stelter, L., & Winqvist, J. (2005) *Cognitive Effects on Mood and Self-Focused Attention.* Poster presented at Celebration of Undergraduate Scholarship, Valparaiso, IN.

Benjamin D. Freer